

# DICLOFENAC: A PAST AND FUTURE THREAT FOR VULTURES

Jaume A. Badia Boher – Biologia Ambiental – June 2015

## Introduction

Diclofenac is a painkiller veterinary medicine highly toxic to many vulture species. Between 1992 and 2007, this drug caused a catastrophic decline in vulture populations across the Indian subcontinent. Diclofenac has recently been approved in Spain. Vultures ingest diclofenac when they feed on cattle that were previously treated with this drug. Diclofenac concentration in cattle carcasses can be lethal to vultures for up to 7 days after the treatment (Fig. 1).

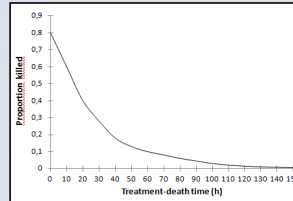


Fig. 1. Proportion of vultures killed due to cattle carcass poisoning depending on the period of time between treatment with diclofenac and death of cattle. Vultures fed on carcasses just after their slaughter.

## Objectives

- To analyze the reasons and consequences of the great vulture decline across the Indian subcontinent, caused by diclofenac.
- To assess the risk that the recent diclofenac approval for veterinary use can pose to vulture populations in Spain.

## The Indian Vulture Crisis

### What happened?



Source: wikipedia (English version)

- 1994: Diclofenac approval
- Affected species: *Gyps bengalensis*, *Gyps tenuirostris*, *Gyps indicus* (Fig. 2)
- Conservation status:
  - 1992: Least Concern
  - 2000: Critically Endangered
- Decline rate (1992 – 2007): 99% (Fig. 3)

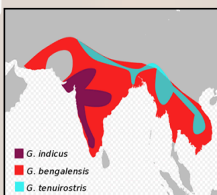


Fig. 2. Distribution of Indian vulture species across Southern Asia. Source: wikipedia (English version)

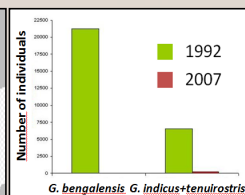


Fig. 3. Number of Indian vultures found in transects made in 1992 and 2007. Source: modified from BirdLife International, 2008.

One of the most rapid declines ever registered in birds!

### Why were the death rates so high?

Due to 3 principal causes:

1. Diclofenac is often applied to cattle soon before their death
2. Vultures identify new carcasses very rapidly (mean: 30 minutes)
3. Vultures eat high quantities of carrion → high risk of ingesting lethal doses

**Demographic model:** if 0,13-0,75% of cattle carcasses were contaminated by lethal doses of diclofenac, all three vulture species would die out (Fig. 4).

2006: high risk of extinction!

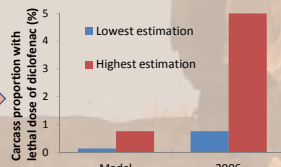


Fig. 4. Model proportions compared to estimated proportions in 2006. Lowest and highest estimations correspond to both edges of the confidence intervals. Source: modified from Green et al., 2004.

### 2006: Diclofenac ban

- **2006:** A new vulture-safe veterinary painkiller is accepted: **meloxicam**.
- **2009:** Substantial decrease in the level of diclofenac contamination since ban.
- **2011:** Vulture populations have stopped decreasing and may even have started growing (Fig. 5).

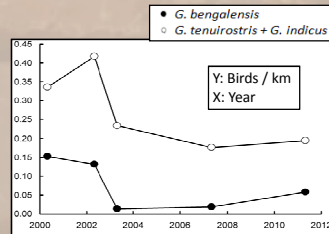


Fig. 5. Vulture density estimations obtained from different vulture transects between 2000 and 2012. Source: Prakash et al., 2012.

### The cost of vulture decline

The Indian Vulture crisis led to:

- Increase in feral dog population → high increase of human rabies cases
- Increase in uneaten carcasses in the field
  - Water, wind and soil pollution
  - Infectious disease outbreaks (e.g. anthrax)
- Higher expenditure in vulture conservation and reintroduction projects

Estimated economic impact (India): **13.100 – 14.600 million euros**

## What could happen in Spain?

### Current context

Spain holds 95% of Europe's vultures

2013: Diclofenac approval. Directions for use:

- It can't be injected to cattle likeable to be consumed by vultures.
- It must be injected under veterinary supervision.

High risk of noncompliance!

### Exposure ways

- Cattle carcasses disposed of in the open air → regulated.
- Dead cattle carried to carcass dumps → usually in a few hours after death.
- Possible use as **illegal vulture poison**.

**NO RISK ASSESSMENTS HAVE BEEN MADE!**

### Diclofenac effect to Spanish vultures

Based on: { -Feeding ecology of different taxa  
- Toxicity data (if available)

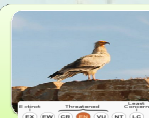


#### Griffon vulture (*G. fulvus*)

- Confirmed high sensitivity to diclofenac
- Cattle carcasses are their main food source
- They eat big quantities of carrion

Expected decrease

**HIGH**

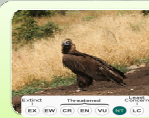


#### Egyptian vulture (*N. percnopterus*)

- Suspected high sensitivity to diclofenac
- Facultative carrion-eater
- They eat small amounts of carrion

Expected decrease

**MILD**



#### Cinereous vulture (*A. monachus*)

- Unknown sensitivity to diclofenac
- They eat cattle carcasses, but also many carcasses from wild animals

Expected decrease

**MILD**



#### Bearded vulture (*G. barbatus*)

- Unknown sensitivity to diclofenac
- They eat mainly bones (low-contaminated)
- They feed on carcasses long after their death

Expected decrease

**LOW**

Sources: Jaume A. Badia Boher (vulture photographs); Wikipedia, English version (conservation status signs)

## Conclusion

- 1) Diclofenac made Indian vultures face extinction in less than a decade.
- 2) Data show vulture extinction is possible with a very low proportion of poisoned carcasses → **high risk in Spain!**
- 3) Spanish vulture decline is not expected to be as fast as Indian decline. *Gyps fulvus* could be the most affected species.
- 4) Precautionary approach should be applied → diclofenac should be immediately banned in Spain.
- 5) European Medicines Agency could establish diclofenac withdrawal soon.

### Bibliography

BirdLife International (2008). Asian vulture populations have declined precipitously in less than a decade. Presented as part of the BirdLife State of the world's birds website. Available from: <http://www.birdlife.org/datazone/now/status/113>. [Checked: 29/05/2015].  
R. E. Green, J. Newton, S. Shultz, A. A. Cunningham, M. Gilbert, D. J. Pain, and V. Prakash. "Diclofenac poisoning as a cause of vulture population declines across the Indian subcontinent." *J. Appl. Ecol.*, vol. 41, pp. 793–800, 2004.  
V. Prakash, M. C. Bhowmik, A. Choudhary, R. Cutler, R. Datta, M. Kulkarni, S. Kumar, K. Paudyal, S. Ranby, R. Shringarpure, and R. E. Green. "The population decline of Gyps vultures in India and Nepal has slowed since veterinary use of diclofenac was banned." *PLoS One*, vol. 7, no. 11, e48513, 2012.